

Evidence-Based Practice Guideline Development: Selection of Local Anesthetics and the Additive Dexamethasone in Brachial Plexus Blocks

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Executive Summary

- **Background:**

Brachial plexus blocks (BPB) are used to inhibit sensory and/or motor function in the upper extremity

Efficacy of a BPB depends on the type and dose of local anesthetic (LA), as well as use of any additive agent

Dexamethasone has been shown to increase motor and sensory block duration

- **Clinical Problem:**

The target hospital lacked standardized evidence-based practice (EBP) guidelines for the choice of LA and additive in BPB

- **Project Purpose:**

Synthesize the evidence around the use of LA and dexamethasone with BPB

Develop a guideline based on the evidence

Present it to the Clinical Process Improvement Team (CPIT)

Introduction & Problem Identification

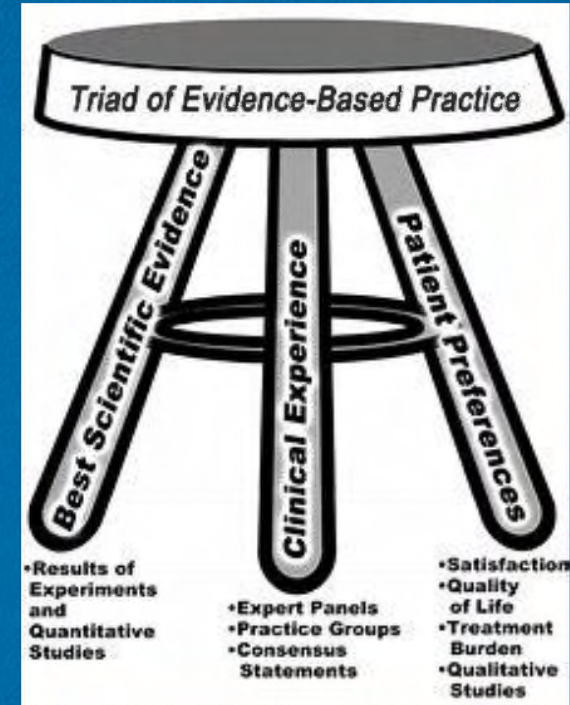
Introduction & Background

- BPB are a type of regional anesthesia
 - LA is injected near a group of nerves in the neck
 - Motor and/or sensory inhibition of the upper extremity can last from hours to a day (Kukreja et al., 2019)
 - Efficacy depends on type and dose of LA, as well as additives
- Certain additives, such as dexamethasone, have been shown to increase sensory and motor block duration and decrease postoperative opioid requirements when added to BPB (Choi et al., 2014)



Clinical Problem

- Chart audits revealed a wide variability of clinical practice in the use of LA and additives in BPB among the anesthesia providers at the at the large Level 1 trauma center
- The hospital lacked an EBP guideline for the choice of LA and additives for BPB, which may have also contributed to the current state of inconsistent practice among providers



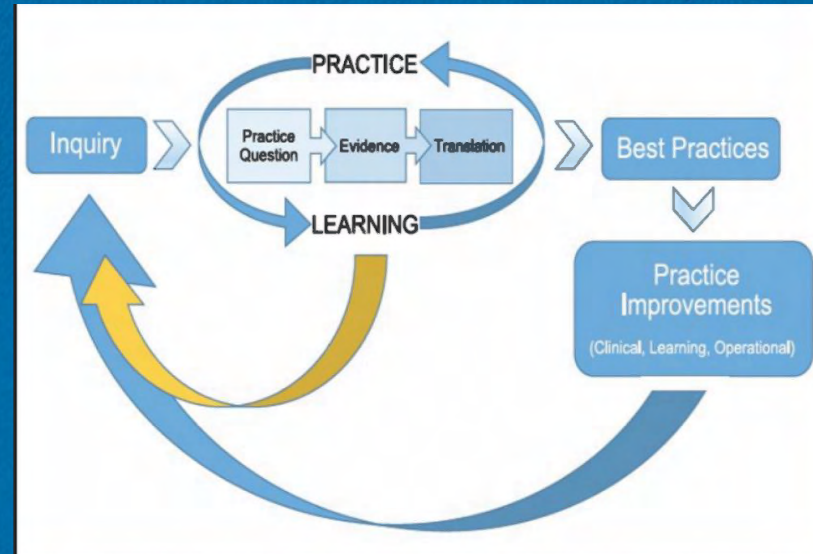
Project Implementation and Measures

Project Purpose

- Developed and provided the hospital with a practice guideline using the best evidence from the literature
- The final guideline was not implemented due to time constraints
- However, feedback from different committees were utilized to learn critical aspects and to gain experience in creating a guideline
- Project goals:
 - Synthesize the evidence around the use of LA and the additive dexamethasone with BPB
 - Develop a guideline based on the evidence
 - Present the guideline to the Clinical Process Improvement Team (CPIT)

Johns Hopkins Nursing Evidence-Based Practice (JHNEBP) Model

- A clinical problem solving and decision-making model
- Helps address clinical needs using practice questions, evidence, and translation
- Permission was granted by John Hopkins University to use the tool.
- The project will follow the JHNEBP Model up through Step 3 “Best Practices”
- The project will provide a plan for future implementation which will include Step 4.



Step 1: Inquiry

Inquiry Findings

Paper list of individual preferences for 25 providers on LA and additive combinations

Majority of providers used 30 ml of 0.5% ropivacaine

46.4% of providers used the additive dexamethasone

No specific department guidelines/protocols related to the utilization of LA and additives in BPB

Step 2: Practice Learning

Practice Question

- In patients who received BPB (P) how does the use of 30 ml 0.5% ropivacaine and the additive agent dexamethasone (I) compared to BPB with varied LA types or volumes without an additive agent (C) affect postoperative patient outcomes?

Current Evidence: Local Anesthetics

- Ropivacaine was the main LA assessed in most of the studies
- Ropivacaine concentrations (Zhai et al., 2016)
 - Onset of 50 mg ropivacaine in three different concentrations
 - 6.7 ml of 0.75%, 10 ml of 0.5%, and 20 ml of 0.25%
 - Onset times were significantly quicker in 0.75% group
 - Most patients did not achieve complete motor blockade within 30 minutes in 0.25% group
- Combination of lidocaine and ropivacaine (Nakayama et al., 2017)
 - Combination of agents did not influence the evaluation items
- Bupivacaine vs ropivacaine (Bindal et al., 2018)
 - More significant increase of duration of analgesic block, duration of sensory block, and duration of motor block with ropivacaine than bupivacaine

Current Evidence: Additive Dexamethasone

- Effectiveness of dexamethasone (Pehora et al., 2017):
 - Dexamethasone prolonged block duration of action
 - Pain was significantly lower with dexamethasone up to 24 hours
 - Opioid consumption was lower up to 48 hours
- Different doses of dexamethasone:
 - 4 mg had similar outcomes as 8 mg (Holland et al., 2018)
 - Even 1 mg prolonged the duration of action (Chalifoux et al, 2018)
- Potential adverse effects of dexamethasone (Kahn et al., 2018):
 - Longer sensory block duration than desired period
 - Transient increase in blood sugar level
 - Increased risk of infections among immunocompromised patients

Current Evidence: Postoperative Pain

- Approximately 80% of postoperative patients experienced acute pain which is moderate to severe in nature. (Chou et al., 2016)
- Commonly, providers will utilize opioids to manage postoperative pain in shoulder surgery patients
 - 8.2% of patients who underwent shoulder surgeries required opioid medication for the first 30 days (Gil et al., 2019)
- Patients experiencing moderate to severe pain postoperatively tend to require higher opioids.

Translation

- Identified key stakeholders from the pharmacy and anesthesia departments to help develop clinical practice guidelines on LA and additive agents use in BPB
- The guideline draft was presented to the CPIT committee in an October 2021 scheduled meeting
 - A copy of the guideline draft and project proposal paper were distributed to all CPIT members
 - Feedback was received and considered in final guideline

Step 3: Best Practices

Guideline Development

- Total of 23 studies (SRs + RCTs) were analyzed
- John Hopkins Nursing EBP: Evidence Level and Quality Guide was used to analyze the level of evidence for 22 selected studies
 - *Systematic way to evaluate sample size, methods, findings, and conclusions*
 - 11 high quality literature
 - 8 good quality literature
 - 3 low quality literature
- Most of the studies suggested 30 ml 0.5% ropivacaine with dexamethasone 4 mg is most appropriate to provide post-op pain management
- Submitted the evidenced-based clinical practice guideline to the anesthesia and pharmacy departments for further review and approval

Step 4: Practice Improvement

Practice Improvement (Future)

- The project team was unable to implement the guideline due to the nature of the DNP program's academic/curricular timeline
- The EBP guideline was communicated to the anesthesia and pharmacy departments for potential future implementation



Analysis and Outcome Evaluation

Project Evaluation

- Evaluation of the project involved the ability to:
 - Collect and appraise data through SR and local/national/standard clinical practice guidelines
 - Develop a EBP guideline and submit for initial committee review
- Incorporation of the newly developed EBP guidelines into clinical practice may lead to improvements in patient outcomes

Limitations

- Current members were not able to implement the guideline
- The project timeline was impacted by the ongoing COVID-19 pandemic
 - The first scheduled CPIT meeting had to be rescheduled due to hospital mandates.
- The project's findings were based on a literature review
 - Findings might differ if a RCT is performed at the selected hospital

Implications for Future Projects

- Creation of the guideline can provide hospital leadership with evidenced-based recommendations that can be used to help streamline and improve the quality and consistency of future anesthesia delivery of BPB
- The findings of the scholarly project also served as a beginning point for a greater understanding of the importance of EBP, clinical knowledge, policy, and anesthesia practice impacts on outcomes of post-operative patients
- The project serves as a model to help incoming DNP students create a guideline or allow students continuation of the project.

Project Timeline

January – April 2021	Institutional Review Board (IRB) process
May – August 2021	EBP guideline data collection & clinical practice guideline approving committee meetings
September – December 2021	EBP guideline development & final scholarly report
January – March 2022	Project defended & disseminated

SWOT Analysis

Strengths:	Weakness:
<ul style="list-style-type: none">- 46.4% of providers were utilizing additives- The most used additive was dexamethasone- The most used LA was ropivacaine- Additive helped with better pain management and sensory block	<ul style="list-style-type: none">- Lack of LA & additive guidelines- Lack of pre-set orders- Lack of individual variation consideration while administering additives
Opportunities:	Threats:
<ul style="list-style-type: none">- Improved block process and time- Improved block duration of action- Improved postoperative patient outcomes	<ul style="list-style-type: none">- Providers reluctant to change- Lack of preferred additives- Individual experience

Guidelines

OhioHealth GUIDELINE DRAFT	
TITLE: Selection of Local Anesthetics and the Additive Dexamethasone in Upper Extremity Nerve Blocks	NUMBER:
ISSUE DATE:	EFFECTIVE DATE:
DEVELOPED / REVISED BY: Sabina Lamichhane-Wagle & Alexandra McGuire	
REVIEWED BY: Department of Anesthesiology Surgery/Anesthesia CPIT	DATE REVIEWED:
APPROVED BY:	

SCOPE - This guideline is in effect for the following OhioHealth system business units: Grant Medical Center

STATEMENT OF PURPOSE:

The purpose of this guideline is to provide evidence-based practice recommendations regarding the selection of local anesthetics (LA) and the additive dexamethasone in brachial plexus blocks (BPB). BPB efficacy can be affected by the type and dose of LA, as well as use of any additive agent. Additive agents, such as dexamethasone, are added to LA to increase motor and sensory block duration, to provide analgesia, and decrease opioid requirements. Selection of LA and the additive agent dexamethasone includes assessing their indication and contraindications, risks and benefits, types of surgery, required block duration, and institution of corrective measures to address for any complications.

Consideration generally includes:

- Obtaining appropriate pre-op assessment of the patient.
- Addressing patients' consents and surgeons' preferences.
- Availability and costs of the LA and additive.
- Utilizing technical aspects during administration, such as ultrasound.
- Availability of anesthesia provider to address complications.
- Availability of medications to address any potential complications (including lipid emulsion).
- Providing appropriate post-anesthesia care following BPB.

DEFINITIONS:

- **Analgesia:** absence of the sensation of pain.
- **Brachial plexus block:** peripheral nerve blockade of the brachial plexus.
- **Motor block:** nerve blockade that paralyzes the motor function of a muscle.
- **Sensory block:** selectively inhibit pain transmission while leaving motor function intact.

POLICY:

The guideline applies to the use of regional anesthesia in which LA and additives are administered to the patient. This guideline assists anesthesia providers in the selection of LA and the additive dexamethasone for BPB. The guideline is intended to direct quality patient care without guaranteeing a specific patient outcome. The guideline is not a substitute for clinical judgment and does not establish legally enforceable requirements or responsibilities. The 2017 American Society of Anesthesiologists guidelines should be consulted directly.

GUIDELINE

I. Local Anesthetic Selection

A. Type:

1. Ropivacaine is the recommended type of local anesthetic:
 - a. Rationale for recommending Ropivacaine:
 - 1) Ropivacaine has faster a sensory and motor onset
 - 2) Ropivacaine showed stronger effects with the additive dexamethasone compared to Bupivacaine
2. Other local anesthetics that can be used:
 - a. Bupivacaine
 - 1) Bupivacaine has demonstrated an enhanced motor blockade, but also demonstrated more cardiac toxic effects
 - b. Lidocaine and Ropivacaine
 - 1) No statistical differences between varied doses of LA combinations
 - 2) Higher lidocaine volume can cause more negative side effects, such as lower pulse oximetry levels and local anesthetic toxicity

B. Dose:

1. 30 ml of 0.5% Ropivacaine is the recommended dose
2. Other local anesthetics doses that can be used:
 - a. 30 ml of 0.5% of Bupivacaine
 - b. 10 ml 1% Lidocaine and 20 ml 0.75% Ropivacaine
3. Volume may vary depending on UNB location

C. Recommended criteria:

1. Common inclusion criteria:
 - a. ASA physical status I-III, 18-65 years old, upper extremity surgery
2. Common exclusion criteria:
 - a. Allergy to amide LA, short duration of blockade

II. Dexamethasone Selection

A. Route:

1. Perineural dexamethasone is the recommended route
2. Intravenous dexamethasone can also be used

B. Dose:

1. 4 mg of perineural dexamethasone is the recommended dose:
 - a. Studies showed 10 mg of dexamethasone had same effects as 4 mg
 - b. Higher doses (> 4 mg) were associated with perineal pruritus, paresthesia, transient increase in blood sugar level, and increased risk of infections
2. < 4 mg of dexamethasone can also be used
 - a. 1 mg dexamethasone is better for pain management than not using dexamethasone

C. Recommended criteria:

1. Common inclusion criteria:
 - a. ASA physical status I-III; 18-65 years old; elective ambulatory surgery
2. Common exclusion criteria:
 - a. Allergy to dexamethasone; long-term steroid therapy; immunocompromised patients; uncontrolled diabetes mellitus

Questions?

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